SD
11
.R8

618

JOSEPH E. KOST

A HARDWOOD THINNING PROGRAM

for the

OZARK NATIONAL FOREST

U. S. DEPARTMENT OF AGRICULTURE–FOREST SERVICE

Property of
National FS Library
USDA Forest Service
240 W Prospect Rd
Fort Collins CO 80526

SUMMARY

The Ozark region of Arkansas can reap phenomenal economic benefits from an expanded hardwood thinning program on the Ozark National Forest. Data from a recent stand-mapping project indicate that there are about 160,000 acres of stagnated, overstocked hardwood poletimber in need of thinnings. One man-day of local labor is needed for each acre thinned. This program can be of material benefit to the under-employed rural labor force and to the local economy.

On the more than 100,000 acres of stands older than 40 years, thinnings would increase the hardwood sawtimber yields during this rotation by about 7,200 board feet per acre. In the younger stands (less than 40 years), the increase in per-acre yields should be even higher. This additional volume would be available during the regeneration cut in stands which are over 60 years old at time of thinning. In stands less than 60 years old, thinnings would increase volumes available for harvest during both intermediate and regeneration cuts. Most of the sawtimber would be converted to wood products locally.

The total boost to the economy if the program were to be fully implemented could be expected to exceed $530,000,000 at present dollar values. The rate of return for dollars invested will average at least 10 percent in the older stands and more in the younger stands.

Wildlife —— particularly deer, squirrel, and turkey —— is certain to benefit. The thinning will mean more mast production and ground vegetation, thus increasing the carrying capacity of the land.

A Hardwood Thinning Program For The Ozark National Forest

A PROPOSED PRECOMMERCIAL THINNING PROGRAM WITH A DISCUSSION OF COSTS AND BENEFITS

by James Roy Crouch

This project is a joint effort by the Branch of Silviculture, Division of Timber Management, and the Forest Supervisor and Staff, Ozark-St. Francis National Forests.

JUNE 1970

SOUTHERN REGION – FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

CONTENTS

INTRODUCTION ---- 3

THE FOREST ---- 6

BENEFITS ---- 6

GROWTH TRIPLED WITHOUT LOWERING QUALITY ---- 8

HARDWOOD SAWTIMBER CUT INCREASED ---- 10

WILDLIFE CARRYING CAPACITY RAISED ---- 10

ECONOMIC BENEFITS TO OZARK REGION ---- 10

COSTS ---- 10

CONCLUSION ---- 11

SOURCES CITED ---- 12

APPENDIX ---- 13

INTRODUCTION

The Ozark National Forest has more than 160,000 acres of stagnated, overstocked hardwood poletimber stands urgently in need of precommercial thinning (Table 1). For decades prior to the establishment of the Ozark National Forest repeated fires destroyed periodic accumulations of small trees. The end result was a stand of large trees, primarily hardwoods. With the establishment of adequate National Forest fire protection in the late 1920's, an understory of young hardwood trees developed on the better sites. In the 1930's and 1940's this understory was released by cutting the merchantable overstory, mostly white oak, and girdling the culls and wolf trees. Today, many of these sites are overstocked with poletimber (Figure 1) to the extent that growth is retarded and other resource objectives are impaired.

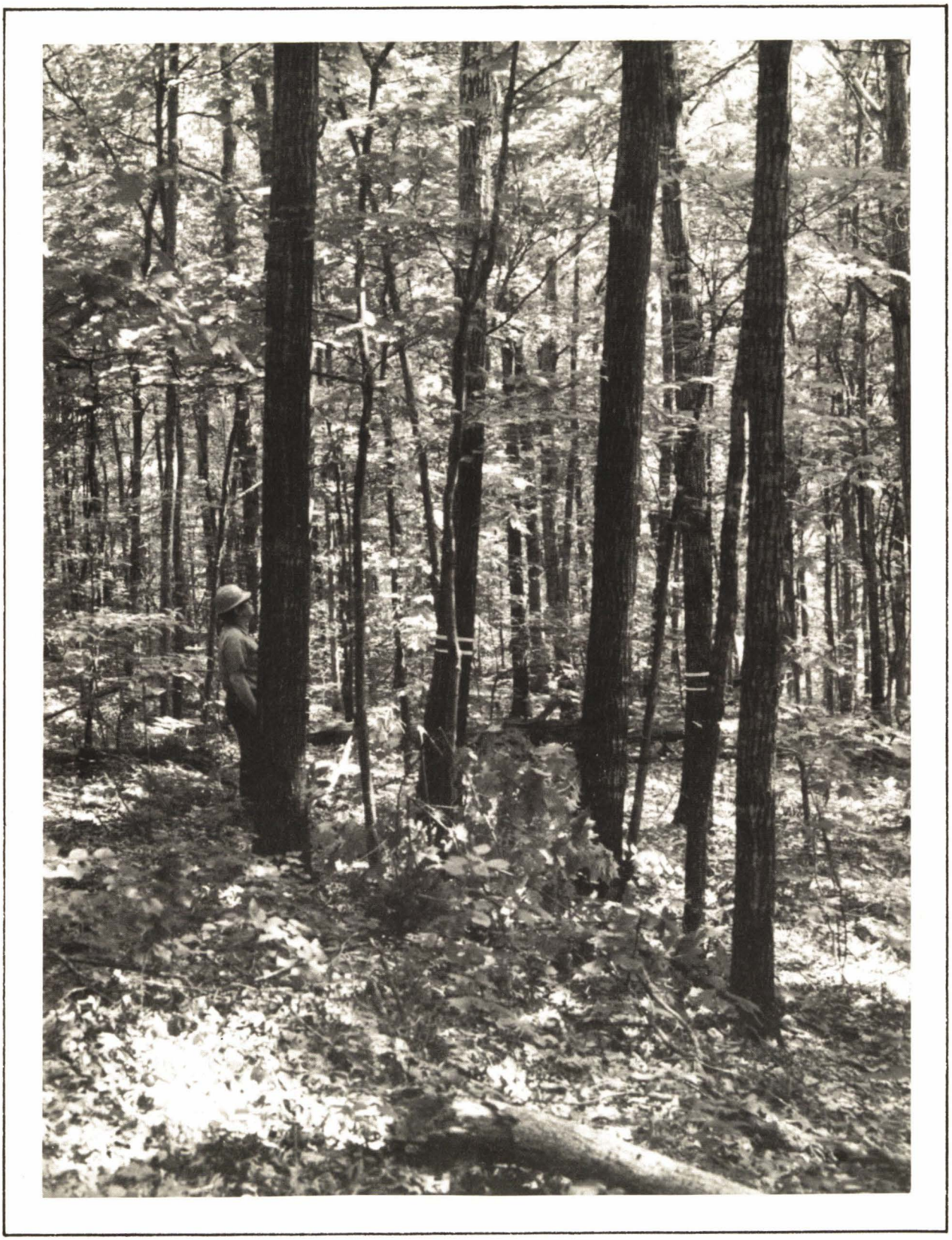

FIGURE 1 — Typical stagnated, overstocked oak poletimber stand on the Ozark National Forest.

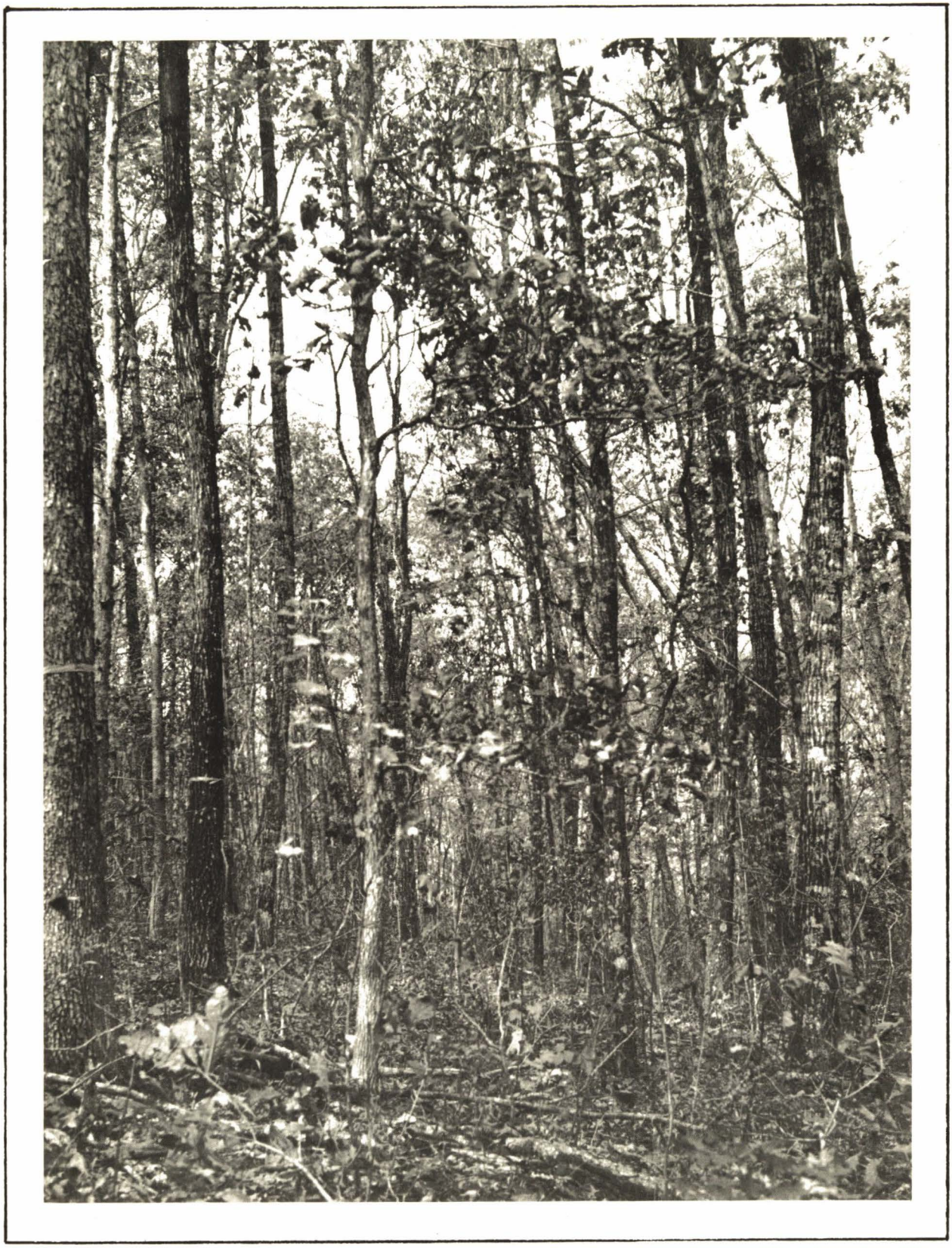

FIGURE 2. – Poor crown development typical of many oak poletimber stands on the Ozark National Forest.

THE FOREST

The main unit of the Ozark National Forest lies on the Boston Mountain Plateau. The area is characterized by narrow ridges, occasional benches, and "v" shaped valleys. Elevations seldom exceed 2200 feet above sea level. Principal soil series are Allen, Jefferson, Hector, Rarden, and Linker.

The Boston Mountain and Sylamore Working Circles include 986,808 acres of which about 928,000 acres are available for accelerated timber production. Forty percent of the forestland is managed for hardwoods and the rest for pine. Hardwood stands have a measured site index of 70-90 for oak. Pines are typically found on soils with a site index of less than 70.

North and east slopes are occupied by extensive stands of stagnated, overstocked, mostly 30-to 60-year-old hardwood poletimber. Trees ranging from 5 to 9 inches in diameter predominate, with stocking of dominants and codominants running from 150 to 300 per acre. Current diameter growth rate is about one inch in 10 years (Table 2). Growth in these stands will probably continue at about the present rate with only a few trees reaching sawtimber size by rotation age unless steps are taken soon to reverse the unfavorable trends in stand development.

Sawmill capacity in the area now exceeds the allowable hardwood cut. Both Working Circles are glutted with small trees, but lack an inventory of large hardwood poletimber and hardwood sawtimber.

There is little reason to expect major outlets for hardwood pulpwood to appear within the next 10 to 20 years. The extremely slow growth rate, the strong demand for hardwood sawtimber, and the lack of a pulpwood market make it highly desirable for the Forest to accelerate treatment of hardwood poletimber stands to meet MUM objectives and the needs of the local economy.

The dense hardwood poletimber stands now provide only a minimum of palatable browse and mast for wildlife. Recent analyses of browse on the Ozark National Forest disclosed that yields averaged about 90 pounds per acre in the summer and 10 pounds per acres in the winter. Overstocking has caused shortening and narrowing of the crowns of many of the trees (Figure 2). Trees with these characteristics are usually poor mast-producers.

BENEFITS

The benefits described below are based on two studies installed in stands on the Buffalo and Boston Mountain Ranger Districts in FY 1969, plus pertinent research findings and field observations. The two selected stands are representative of the large acreages of stagnated, overstocked hardwood poletimber on the Ozark National Forest. Management type is white oak – red oak – hickory. The measured site index for the two stands is 80 for red oak with a current diameter growth rate of about one inch in 10 years (Table 2). The following tabulation gives further data on the selected stands.

ITEM	STAND LOCATION	
	BUFFALO RD	BOSTON MTN. RD
Age	60	50
No. trees 4" dbh & larger per acre before thinning	182	260
No. crop trees 4" dbh & larger per acre after thinning	68	95
Per acre BA for those trees 4" dbh & larger before thinning	95	70
Per acre BA for crop trees after thinning	50	34
Avg. dbh of original stand including those trees 4" dbh & larger	9.3"	7.3"
Avg. dbh of selected crop trees after thinning	11.0"	8.1"
Avg. spacing of those trees 4" dbh & larger before thinning	15'x 15'	11'x 11'
Avg. spacing of crop trees after thinning	25'x 25'	22'x 22'

Research and field observations show that stagnated oak in unmanaged stands responds to heavy thinnings at much greater ages than once was thought. In unmanaged stands,

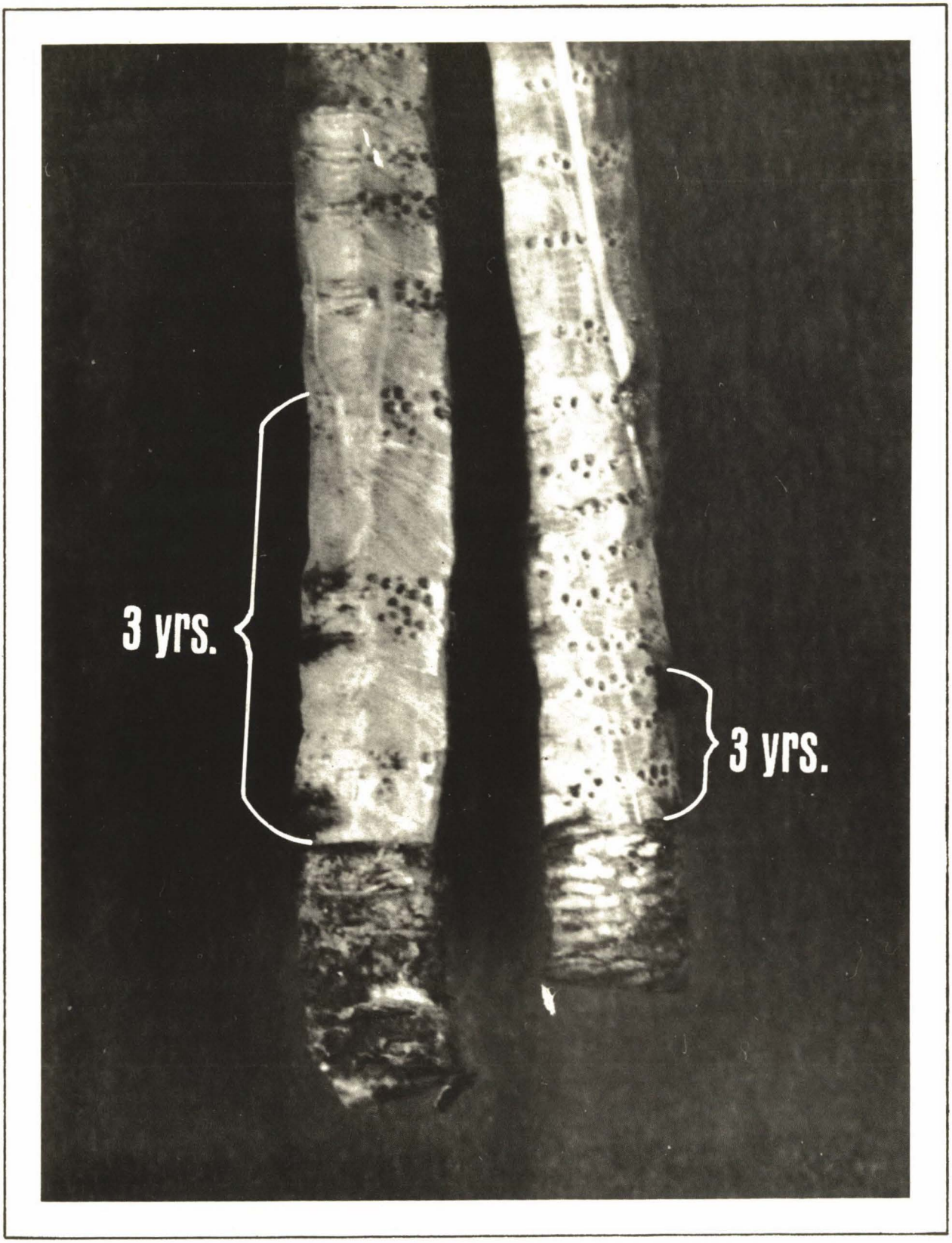

FIG.3 —When stagnated, overstocked red oak poletimber stands in the Ozarks are heavily thinned, growth response is prompt and impressive. The increment core on the left came from a stand thinned to 40 square feet of basal area. The core on the right shows slower growth when a comparable stand was thinned to 80 square feet BA. Both stands had original basal areas of 90-110 square feet.

thinnings may be useful even at ages beyond 70 on good sites (Arend and Scholz 1969). Minckler (1957) reported that many century-old poletimber-size white oaks still had good crown form and responded well to thinning. Minckler reports that crop trees grew 41% faster the first year after thinning than during the average of the previous ten years. Figure 5 shows the immediate growth response made by a 93-year-old Northern red oak on the Ozark National Forest after complete crown release.

GROWTH TRIPLED WITHOUT LOWER QUALITY

Foresters have long recognized the value of thinning for increasing and maintaining acceptable growth rates. By reducing the number of trees per acre, growth of the residual trees is stimulated and the volume is accumulated on a smaller number of more valuable trees.

Data gathered on the Ozark NF shows that stagnated dominants and codominants in overstocked oak poletimber stands will respond to heavy thinnings (Figure 3) by growing as much as 3 inches or more in diameter the first 10 years after crown release (Figure 4 and Table 2). Trimble (1968) found that red oak sawtimber trees on site 85 land near Parsons, West Virginia grew as much as 3.9 inches in diameter in ten years after thinning to 60 square feet of basal area.

FIGURE 4 — Typical diameter response of red oak to heavy thinning. Growth is shown in 25 year radial increments.

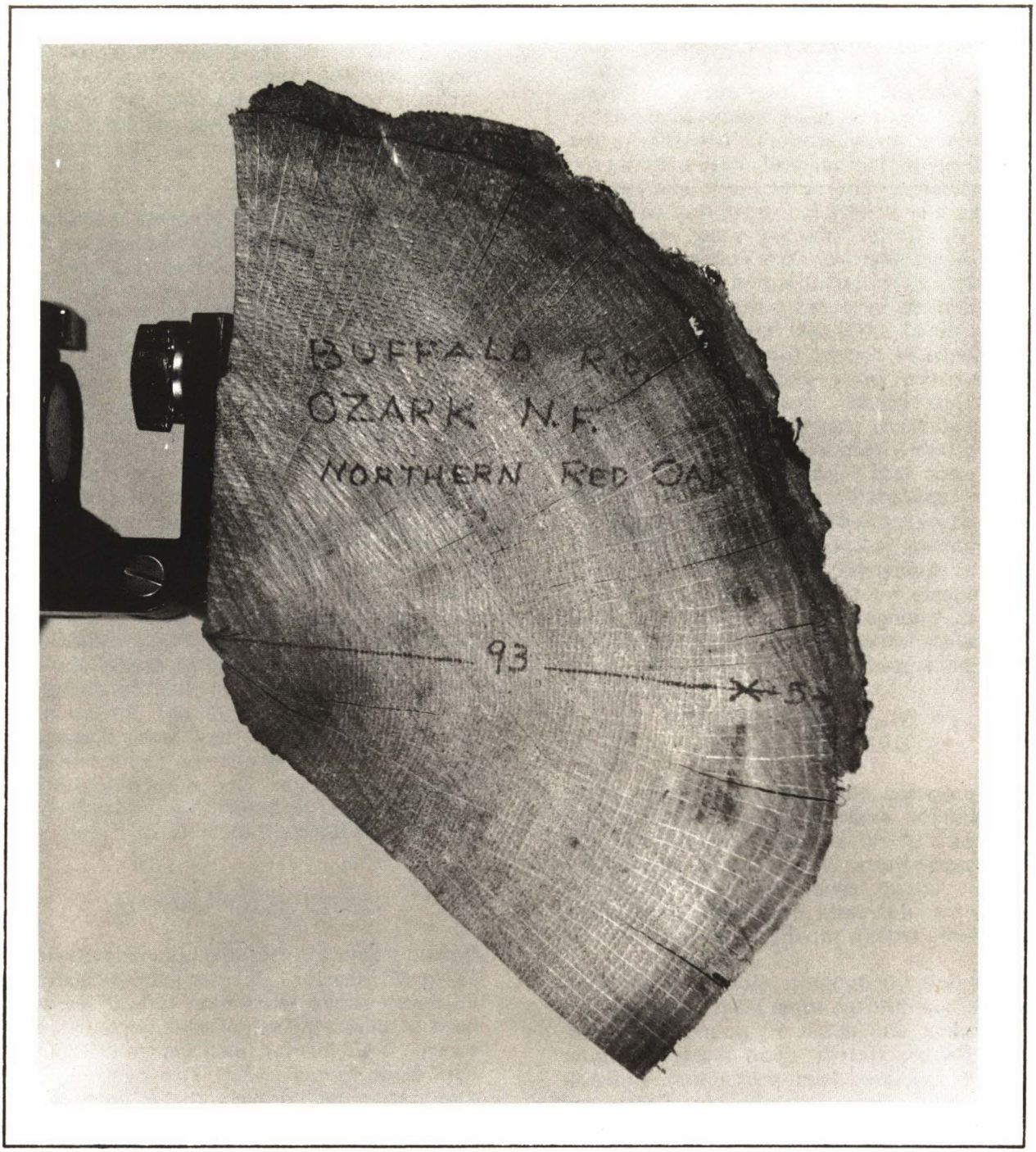

FIGURE 5 — Oaks on hardwood sites will respond to heavy thinnings at much greater ages than once was thought. Note increased radial growth for the 5-year period following release.

Studies indicate there is little or no reduction in quality due to epicormic branching as long as 15 to 20 square feet of basal area in stems in the 1 to 5 inch DBH Class remain to shade the first two logs of larger stems (Trimble 1968) even though the main stand is thinned to as low as 45 square feet of basal area.

In thinning stagnated, overstocked oak pole-timber stands, whether precommercial or commercial, only those stems larger than 5-6 inches DBH normally are removed. This leaves the trees smaller than 5 inches DBH to serve as trainers, by shading the merchantable boles of the selected crop trees.

HARDWOOD SAWTIMBER CUT INCREASED

The increased growth from thinnings would provide a large addition to the hardwood sawtimber available for cutting during this rotation. In turn, the larger volumes of timber would yield many economic benefits for the Ozark region. The value of these benefits can be calculated. The cost-benefit analysis for the thinning studies indicated that within 20 to 30 years after thinning, a net increase of 7,200 board feet per acre could be realized. Another way to put it is that from each 139 acres thinned in stands older than 40 years, an additional 1,000,000 board feet of cut can be realized at harvest time. A larger volume increase can be expected when younger stands are thinned. If all the 160,000 acres of overstocked, stagnated poletimber stands on the Ozark National Forest were thinned on a crop tree basis as was done in these studies, the addition to the hardwood sawtimber yields can be expected to exceed one billion board feet during this rotation period. In older stands (60+) this increased yield will be available for harvest at time of regeneration. In younger stands the additional yield will be harvested through both intermediate and regeneration cuts.

WILDLIFE CARRYING CAPACITY RAISED

The proposed thinning program has many benefits for wildlife. Benefits for the first 3-7 years would include increased yields of understory fruits, browse, forbs, and grasses. As the crown canopies close, understory vegetation decreases and mast yields from expanding crowns rapidly increase.

Vegetation yields under closed-canopy hardwoods now average some 90 pounds per acre in summer and about 10 pounds in winter. Deer depend heavily upon mast for winter survival and good fawn production. However when mast crops fail, the abundance and variety of understory plants in overstocked stands is inadequate to support the deer herd. Thinnings could be expected to significantly increase the understory vegetation and maintain a healthy deer herd at relatively high population levels.

Thinning guidelines would favor a variety of desirable game-food trees needed for balanced year-long food supplies. Special care is needed to favor food trees in stand composition and to retain den and roost trees. Increased mast would favor gains in turkey and squirrel populations.

ECONOMIC BENEFITS TO OZARK REGION

Increased timber growth and improved wildlife habitat would bring both short- and long-range benefits. Although some benefits are difficult to forecast and evaluate, one facet of a thinning program that can be predicted readily is the economic gain to the local economy.

The Ozark NF thinning program is estimated to require one man-day of hand-labor per acre. To date, precommercial thinning has been accomplished by force account. In the future, a combination of force account and local contract crews would be needed. Expenditures from the program would enter the local economy through salaries, wages, equipment, and supplies. Total expenditures for the thinning program are estimated to be $4,100,000.

At current stumpage rates, the increase in hardwood sawtimber yields as a result of thinning would be expected to generate over 530 million dollars of additional business during this rotation period. This addition to the total economy is based on the generally accepted principle that one dollar of stumpage generates about 15 dollars of business through processing, selling, and transporting the end product to the consumer.

Tax bases are low in the Ozarks. Population is sparse. Any local increase in income is of major importance. The proposed thinning program would do much to promote development in this largely rural area.

COSTS AND PROGRAM

Costs to date for thinning operations average about $25 per acre. A recent stand-condition inventory shows more than 160,000 acres in need of thinning. Only a small portion of this acreage is eligible for financing from Cooperative Work Funds (K-V). Treatment for the other acres would have to be financed by appropriated funds for reforestation and stand improvement projects. Estimated total cost for the project would be $4,100,000 using present dollar values.

At the present rate of progress, it would take more than 160 years to do the necessary cultural work. If the Ozark National Forest is to maximize benefits to dependent communities, these stagnated, overstocked, oak poletimber stands should be thinned during the next 10 years. Such a program would require thinning 16,000 acres per year – a 16-fold increase over the present program.

CONCLUSION

The modal project and supporting data demonstrate that the benefits from thinning are many. An aggressive precommercial thinning program on the Ozark National Forest would not only increase the rate of growth and increase the timber available for cutting, but perhaps just as important, would aid the local economy and improve wildlife habitat.

While much of the data contained in this report come from the Ozark National Forest, the supporting evidence drawn from other areas suggests that this approach may apply to other stagnated oak stands throughout the Southern Region. There are several hundreds of thousands of acres in need of thinning on National Forest lands in Georgia, Kentucky, North Carolina, Tennessee, and Virginia.

SOURCES CITED

1. Arend, John L. and Julander, Odell.
1948. Oak Sites in Arkansas Ozarks. Agricultural Experiment Station, University of Arkansas. Bulletin 484, 42 pp., illus.

2. Arend, John L. and Sholz, Harold F.
1969. Oak Forests of the Lake States and their Management. U.S.D.A., Forest Service, North Central States Forest Exp. Sta. Res. Paper NC-31, 36 pp., illus.

3. Minckler, Leon S.
1957. Response of Pole-size White Oak Trees to Release. J. Forestry 55: 814-815, illus.

4. Trimble, George R., Jr.
1968. Growth of Appalachian Hardwoods as Affected by Site and Residual Stand Density. U.S.D.A. Forest Service, NE Forest Exp. Sta., Res. Paper NE-98, 13 pp.

APPENDIX

TABLE 1 – INVENTORY OF PRECOMMERCIAL THINNING NEEDS – OZARK NATIONAL FOREST 1/

STAND CONDITION CLASS	MGT. 2/ TYPE	RANGER DISTRICTS					
		BAYOU	BOSTON MOUNTAIN	BUFFALO	PLEASANT HILL	SYLAMORE	TOTAL
Immature 3/	51	–	120	–	–	1,900	2,020
Poletimber	53	27,000	53,000	28,000	26,000	12,000	146,000
	54	–	500	80	400	1,500	2,480
Low Quality	51	–	–	–	–	150	150
Poletimber	53	2,000	1,000	6,000	1,500	1,500	12,000
	54	–	–	–	–	25	25
Total	51	–	120	–	–	2,050	2,170
Precommercial	53	29,650	54,150	34,500	27,520	14,300	160,120
Thinning Needs	54	–	500	80	400	1,525	2,505

1/ Source of data – FY 69 Stand Mapping Project

2/ 51 – Post oak – Black oak
53 – WO – RO – Hickory
54 – White oak

3/ Acres by Age Class
10-20 yrs. –– 191
20-30 yrs. ––6166
30-40 yrs. –41477
40-50 yrs. –66479)
50-60 yrs. –30167) 102,666 AC
60-70 yrs. – 5475)
70-80 yrs. – 545)
TOTAL 150,500 AC

TABLE 2 – GROWTH RATES FOR OZARK HARDWOODS 1/

SPECIES	AVERAGE TREE AGE AT TIME OF RELEASE	DIAMETER GROWTH RATE 10 YR. PERIOD PRIOR TO RELEASE (INCHES)	DIAMETER GROWTH RATE AFTER RELEASE (INCHES)		
			1st 10 yrs.	2nd 10 yrs.	3rd 10 yrs.
Northern Red Oak & Other hardwoods (except white oak)	45	1.0	3.6	3.7	3.2
White oak	45	1.0	3.0	2.6	2.5

1/ *Growth rates determined from 67 sample stumps on four different sale areas in the Ozark National Forest. Stumps used showed a definite extended period of suppression prior to release.*

COST/BENEFIT ANALYSIS FOR THE THINNING STUDIES

In analyzing the internal rates of return for these two studies one must realize that the rates were computed using the current Ozark NF stumpage prices. Because of the low volume per acre and poor quality, stumpage in the Ozarks is quite low.

The computations in this report are based on the Southern Region's present rotation age of 80 years for upland hardwoods. However, it's quite possible that many of the stands thinned precommercially would receive intermediate cuts and be carried well beyond age 80 before making the regeneration cut.

Future regeneration cuts from these thinned stands would yield larger volumes of better quality timber than is now available. These two factors plus a rapidly changing "supply-demand" situation would result in much higher stumpage prices in the future. As a result the true internal rates of return would probably be nearer 18 percent. The rates shown on page 16 and 17 are considered conservative.

1. BUFFALO RD STAND

A. EXPENSE & INCOME FROM PRECOMMERCIAL THINNING

STAND AGE	SPECIES	1970 VALUE PER MBM	THINNED STAND VOLUME/AC MBM	UNTHINNED STAND VOLUME/AC –MBM–	PER ACRE MARGINAL SCHEDULE	
					MBM	DOLLARS
60 Precommercial Thinning @$25/ac	–	–	–	–	–	$25
80 Harvest Cut	Mixed Oak	$25	6.693	2.572	4.121	$103.03
	W.O.	$50	1.621	0.699	0.922	$46.10
	Hick & Gum	$15	1.049	0.868	0.181	$2.72
	Ash	$40	1.038	0.212	0.826	$33.04
Total	–	–	10.401	4.351	6.050	$184.89

B. COMPUTATION OF INTERNAL RATE OF RETURN

Internal rate of return is computed in two simple steps——

——First calculate the volume of $(1+i)^n$
——Second find the i that has a corresponding value for n years in a $(1+i)^n$ compound interest table.

$(1+i)^n = R/C$
R = per acre value added
C = per acre project cost
n = number of years from investment to return

$(1+i)^{20} = \$184.89/\$25$
$(1+i)^{20} = 7.3956$
$i = 10.5\%$

INTERNAL RATE OF RETURN IS 10.5%

2. BOSTON MOUNTAIN RD STAND

A. EXPENSE & INCOMES FROM PRECOMMERCIAL THINNING

STAND AGE	SPECIES	1970 VALUE PER MBM	THINNED STAND VOLUME/AC –MBM–	UNTHINNED STAND VOLUME/AC –MBM–	PER ACRE MARGINAL SCHEDULE	
					MBM	DOLLARS
50 Precommercial Thinning @$25/AC	–	–	–		–	$25
70 Intermediate Sawlog Cut	Mixed Oak	$25	0.420	–	0.420	$10.50
	White Oak	$50	1.257	–	1.257	$62.85
	Hick & Gum	$15	0.208	–	0.208	$3.12
	Ash & Maple	$40	–	–	–	–
Total	–	–	1.885	–	1.885	$76.47
80 Harvest Cut	Mixed Oak	$25	2.360	0.639	1.721	$43.03
	White Oak	$50	3.622	0.132	3.490	$174.50
	Hick & Gum	$15	1.168	0.228	0.940	$14.10
	Ash & Maple	$40	0.410	0.060	0.350	$14.00
Total	–	–	7.560	1.049	6.511	$245.63

B. COMPUTATION OF PRESENT WORTH FOR EXPENSE & INCOMES

TIME HENCE	DISCOUNT 1/ FACTOR	MARGINAL SCHEDULE EXPENSE	MARGINAL SCHEDULE INCOME	PRESENT VALUES EXPENSE	PRESENT VALUES INCOME
0	1.0000	$25	–	$25	–
20	6.8508	–	$76.47	–	$11.16
30	17.9316	–	$245.63	–	$13.70
Totals	– –	–	–	$25	$24.86

1/ Given by 1.101 when n is years hence.

THE INTERNAL RATE OF RETURN IS 10.1%